Freeform Search

Database: US Pre-Grant Publication Full-Text Database; US Patents Full-Text Database; US OCR Full-Text Database; EPO Abstracts Database; JPO Abstracts Database; Derwent World Patents Index; IBM Technical Disclosure Bulletins

Term: L25 and 11

Display: 10 **Documents in Display Format:** - **Starting with Number** 1

Generate: ○ Hit List ◉ Hit Count ○ Side by Side ○ Image

Search | Clear | Interrupt

Search History

DATE: Friday, November 18, 2005 Printable Copy Create Case

Set Name side by side	Query	Hit Count	Set Name result set
	DB=PGPB,USPT,USOC; THES=ASSIGNEE; PLUR=YES; OP=OR		
L26	L25 and 11	0	L26
L25	l22 or l23 or l24	295	L25
	DB=PGPB,USPT; THES=ASSIGNEE; PLUR=YES; OP=OR		
L24	(5515285 | 5479157 | 6301531 | 4796206 | 5579235 | 5570087 | 4236215 | 6127947 | 6236917 | 5357517 | 6009360 | 4804937 | 6240365 | 5043736 | 5981907 | 4685061 | 5777580 | 4848133 | 5969433 | 6336065 | 4757454 | 5732074 | 5948025 | 6321142 | 5922037 | 4315251 | 6421009 | 5262774 | 6075458 | 4677558 | 6067007 | 6314366 | 6055426 | 5469049 | 6148212 | 6028537 | 4580127 | 5046007 | 4757463 | 5572204 | 6122514 | 6177867 | 5983161 | 6211818 | 4945759 | 4924418 | 5613205 | 6253122 | 5673305 | 4476531 | 4404639 | 5400018 | 5745049 | 5944768 | 4234921 | 4998205 | 4862371 | 6253129 | 6140956 | 5072397 | 4694408 | 5845272 | 6275773 | 4962456 | 5916288 | 6313791 | 20010045886 | 6236365 | 5398190 | 6169497 | 4831560 | 6154648 | 5535274 | 6141610 | 6151306 | 6321091 | 5173855 | 20020004694 | 5587715 | 4084240 | 5682133 | 5074144 | 5938716 | 4249498 | 5177490 | 4395624 | 6259381 | 5758300 | 6330499 | 5055851 | 5511108 | 4602127 | 6131067 | 5834935 | 4853856 | 6195597 | 5541840 | 6263268 | 6324659 | 4853859 | 5987394 | 20010012976 | 5794165 | 6167255 |	166	L24

4188618 | 6373472 | 6069570 | 4812994 | 6029508 | 2292387 | 6018657 | 5024186 | 6128571 | 6169943 | 4419654 | 5270689 | 5367250 | 5923161 | 4939652 | 6317668 | 5515043 | 5334986 | 6651001 | 5963882 | 6181994 | 6116639 | 6298306 | 5884202 | 6006147 | 5311185 | 5961561 | 5588038 | 6055468 | 5939975 | 4298837 | 5815071 | 6049269 | 4980845 | 5619412 | 6320535 | 6151551 | 5394158 | 6025744 | 5223844 | 5483455 | 6317029 | 5917405 | 5668880 | 6331825 | 6339745 | 5897605 | 5986543 | 6338152 | 5365450 | 6166626 | 5825353 | 6292724 | 5825283 | 4539644 | 6101443 | 5895436 | 4837700 | 5309351 | 4258421 | 6133855 | 4086531)![PN]

DB=PGPB,USPT,USOC; THES=ASSIGNEE; PLUR=YES; OP=OR

L23	('6865458'| '6803861'| '6459968'| '6430485'| '5303163'| '20020173887'| '6263268'| '6757521'| '5506772')[PN]	9	L23
L22	('6865458'| '6803861'| '6459968'| '6430485'| '5303163'| '20020173887'| '6263268'| '6757521'| '5506772')[URPN]	126	L22
L21	L20 or l17	9	L21
L20	L19 and led.clm.	2	L20
L19	L12 and diagnos$.clm.	116	L19
L18	L17 and (pin$ with connect$)	2	L18
L17	L16 AND (data$ with bus)	7	L17
L16	L15 and "LED"	28	L16
L15	L12 and (diagnos$ with test$) and electronic$	91	L15
L14	L12 and l1	0	L14
L13	L12 and l2	0	L13
L12	L11 and test$ and (led$ or (light$))	272	L12
L11	L10 and @ad<=20020920	1445	L11
L10	L4 or 701/33.ccls.	2015	L10
L9	L8 and test$ and (led$ or (light$))	1	L9
L8	L4 and l1	2	L8
L7	L5 and l1	0	L7
L6	L5 and l3	0	L6
L5	L4 and @ad<=20020920	1232	L5
L4	701/2,29,31.ccls.	1759	L4

DB=PGPB,USPT,USOC,EPAB,JPAB,DWPI,TDBD; THES=ASSIGNEE; PLUR=YES; OP=OR

L3	L2 and test$ and (led$ or (light$))	90	L3
L2	L1 and (serial$ with bus$)	98	L2
L1	control$ and (pin adj connector) and uart$ and diagnostic$	165	L1

END OF SEARCH HISTORY

Freeform Search

Database: US Pre-Grant Publication Full-Text Database
US Patents Full-Text Database
US OCR Full-Text Database
EPO Abstracts Database
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Derwent World Patents Index
IBM Technical Disclosure Bulletins

Term: L63 and 162

Display: 10 **Documents in Display Format:** - **Starting with Number** 1

Generate: ○ **Hit List** ◉ **Hit Count** ○ **Side by Side** ○ **Image**

Search Clear Interrupt

Search History

DATE: Friday, November 18, 2005 Printable Copy Create Case

Set Name side by side	Query	Hit Count	Set Name result set
DB=PGPB,USPT; THES=ASSIGNEE; PLUR=YES; OP=OR			
L64	L63 and l62	1	L64
L63	L61 and (reset$ with magnet$)	42	L63
L62	L61 and (reset$ with configur$)	76	L62
L61	vehicle and diagnos$ and magnet$ and @ad<=20020920	14559	L61
L60	l58 not L59	14	L60
L59	L58 and "led"	2	L59
L58	L54 and (diagnos$ or test$)	16	L58
L57	L56 and (diagnos$ or test$)	0	L57
L56	L7 and magnet$	0	L56
L55	L8 and magnet$	0	L55
L54	L3 and magnet$	16	L54
DB=USPT; THES=ASSIGNEE; PLUR=YES; OP=OR			
L53	L7 and magnet$	0	L53
L52	L15 and magnet$	0	L52
L51	L25 and magnet$	0	L51

L50	L17 and magnet$	0	L50
L49	6750787.pn.	1	L49
L48	6343617.pn.	1	L48
L47	L17 and "485"	0	L47
L46	L17 and rs485$	0	L46
L45	L17 and (prepar$ same messag$)	0	L45
L44	L17 and (diagnos$ same messag$)	0	L44
L43	L17 and (diagnost$ same messag$)	0	L43
L42	L17 and (diagnost$ with messag$)	0	L42
L41	L17 and condition$	1	L41

DB=PGPB,USPT,USOC,EPAB,JPAB,DWPI,TDBD; THES=ASSIGNEE; PLUR=YES; OP=OR

L40	L35 and j1587$	0	L40

DB=USPT; THES=ASSIGNEE; PLUR=YES; OP=OR

L39	L35 and j1587$	0	L39
L38	L17 and abs$	1	L38
L37	L17 and serial$	0	L37
L36	L17 and seial$	0	L36
L35	L17 and asyn$	0	L35
L34	L17 and uart$	0	L34
L33	L17 and uart$	0	L33
L32	L17 and reset$	1	L32
L31	L17 and (reset$ and clear$)	0	L31
L30	L17 and bus	1	L30
L29	L17 and 27	1	L29
L28	L17 and ecu	1	L28
L27	L17 and led	1	L27
L26	L17 and 24$	1	L26
L25	L15 and 24$	19	L25
L24	L15 and messag$	2	L24
L23	L16 and messag$	0	L23
L22	L17 and messag$	0	L22
L21	L17 and reset$	1	L21
L20	L17 and series$	0	L20
L19	L17 and connector	1	L19
L18	L17 and micro$	1	L18
L17	5056023.pn.	1	L17

DB=PGPB,USPT,USOC,EPAB,JPAB,DWPI,TDBD; THES=ASSIGNEE; PLUR=YES; OP=OR

L16	L15 AND "abs"	4	L16
L15	L9 AND CONNECTOR$	19	L15
L14	L9 AND (PIN$ AND CONNECT$)	0	L14

L13	L9 AND (PIN$ SAME CONNECT$)	0	L13
L12	L9 AND (PIN$ WITH CONNECT$)	0	L12
L11	L7 AND UART	0	L11
L10	L9 AND UART	0	L10
L9	L8 and "LED"	19	L9
L8	L7 and diagnos$.clm.	21	L8
L7	L6 or l5	87	L7
L6	L4 and @pd<=20020920	86	L6
L5	L4 and @ad<=20020920	87	L5
L4	(abe$ near2 kunihiro) and vehicle and diagnos$	87	L4
L3	kunihiro and vehicle and diagnos$	130	L3
L2	kuhiro and vehicle and diagnos$	0	L2
L1	(abe$ near2 kuhiro) and vehicle and diagnos$	0	L1

END OF SEARCH HISTORY

L18: Entry 2 of 2 File: USPT Oct 12, 2004

US-PAT-NO: 6803861
DOCUMENT-IDENTIFIER: US 6803861 B2

TITLE: Vehicle tracking unit with fault condition diagnosis and related methods

DATE-ISSUED: October 12, 2004

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Flick; Kenneth E.	Douglasville	GA		

ASSIGNEE-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY	TYPE CODE
Omega Patents, L.L.C.	Douglasville	GA			02

APPL-NO: 10/105852 [PALM]
DATE FILED: March 25, 2002

PARENT-CASE:
RELATED APPLICATIONS The present application is a continuation-in-part of U.S. patent application Ser. No. 09/859,727 filed May 17, 2001, now U.S. Pat. No. 6,512,465, which, in turn, is based upon copending provisional application serial Nos. 60/264,811 filed on Jan. 29, 2001; 60/258,005, filed Dec. 22, 2000; 60/251,552, filed Dec. 6, 2000; 60/252,125, filed Nov. 20, 2000; 60/236,890, filed Sep. 29, 2000; 60/246,463, filed Nov. 7, 2000; 60/222,777, filed Aug. 3, 2000; and 60/205,178, filed May 17, 2000, the entire contents of each of which are incorporated herein by reference.

INT-CL: [07] G08 G 1/123

US-CL-ISSUED: 340/989; 340/988, 701/29
US-CL-CURRENT: 340/989; 340/988, 701/29

FIELD-OF-SEARCH: 340/988, 340/989, 340/3.43, 701/29, 701/34, 701/35, 701/213

PRIOR-ART-DISCLOSED:

U.S. PATENT DOCUMENTS

	PAT-NO	ISSUE-DATE	PATENTEE-NAME	US-CL
☐	4837700	June 1989	Ando et al.	364/449

☐	5024186	June 1991	Long et al.	123/179B
☐	5043736	August 1991	Darnell et al.	342/357
☐	5055851	October 1991	Sheffer	342/457
☐	5177490	January 1993	Ando et al.	342/357
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☐	5262774	November 1993	Kuwahara et al.	340/988
☐	5334986	August 1994	Fernhout	342/357
☐	5357517	October 1994	Takebe	714/704
☐	5365450	November 1994	Schuchman	364/449
☐	5398190	March 1995	Wortham	364/460
☐	5483455	January 1996	Lay et al.	364/448
☐	5515043	May 1996	Berard et al.	340/988
☐	5515285	May 1996	Garrett, Sr. et al.	364/460
☐	5570087	October 1996	Lemelson	340/870.05
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☐	5587715	December 1996	Lewis	342/357
☐	5588038	December 1996	Snyder	379/57
☐	5673305	September 1997	Ross	379/58
☐	5682133	October 1997	Johnson et al.	340/426
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☐	5825283	October 1998	Camhi	340/438
☐	5895436	April 1999	Savoie et al.	701/214
☐	5939975	August 1999	Tsuria et al.	340/426
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☐	6069570	May 2000	Herring	340/825.49
☐	6075458	June 2000	Ladner et al.	340/825.49
☐	6101443	August 2000	Kato et al.	701/210
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☐	6128571	October 2000	Ito et al.	701/201
☐	6131067	October 2000	Girerd et al.	701/213
☐	6133855	October 2000	Kim	340/932.2
☐	6140956	October 2000	Hillman et al.	342/357.07
☐	6148212	November 2000	Park et al.	455/456
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☐	6167255	December 2000	Kennedy, III et al.	455/414
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☐	6313791	November 2001	Klanke	342/357.17
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☐	6320535	November 2001	Hillman et al.	342/357.1
☐	6321091	November 2001	Holland	455/456
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FOREIGN-PAT-NO	PUBN-DATE	COUNTRY	CLASS
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Omega Research and Development, Inc., "Omega Thinks Customers Don't Know Jack!",

distributed at Consumer Electronics Show in Las Vegas, NV, Jan. 2001, one page.

ART-UNIT: 2632

PRIMARY-EXAMINER: Tweel; John

ATTY-AGENT-FIRM: Allen, Dyer, Doppelt, Milbrath & Gilchrist, P.A.

ABSTRACT:

A vehicle tracking unit may include a vehicle position determining device, a wireless communications device, and a controller. The controller may cooperate with the wireless communications device and the vehicle position determining device for sending vehicle position information to a monitoring station. The controller may also monitor operation of the vehicle, determine a fault condition of at least one of the vehicle position determining device and the wireless communications device based upon a failure thereof over a predetermined pattern of vehicle operation, store the fault condition, and permit retrieval of the stored fault condition.

41 Claims, 50 Drawing figures

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L64: Entry 1 of 1 File: USPT Jul 1, 1997

US-PAT-NO: 5644491
DOCUMENT-IDENTIFIER: US 5644491 A

TITLE: Self contained multi-function engine monitor and timer for providing engine running time, job time, service time and tachometer functions

DATE-ISSUED: July 1, 1997

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Fiske; Kenton W.	Macedon	NY		
Reehil; Edward G.	Shortsville	NY		
Ley; Herbert F.	Farmington	NY		
Sestito; David L.	Fairport	NY		

ASSIGNEE-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY	TYPE CODE
SenDEC Corporation	Fairport	NY			02

APPL-NO: 08/189321 [PALM]
DATE FILED: January 31, 1994

INT-CL: [06] G06 G 7/70

US-CL-ISSUED: 364/431.04; 364/431.03, 364/551.01, 364/550, 324/392, 324/393, 324/399, 324/379, 324/160, 324/402, 324/166, 324/169, 73/117.3, 73/116, 73/118.1, 123/634
US-CL-CURRENT: 701/102; 123/634, 324/160, 324/166, 324/169, 324/379, 324/392, 324/393, 324/399, 324/402, 701/101, 702/177, 73/116, 73/117.3, 73/118.1

FIELD-OF-SEARCH: 364/431.04, 364/431.03, 364/431.08, 364/431.01, 364/508, 364/557, 364/424.03, 364/550, 364/551.01, 364/431.02, 364/431.11-431.12, 324/391, 324/393, 324/399, 324/402, 324/378, 324/394, 324/149, 324/156, 324/379, 324/395, 324/115, 324/642, 324/160, 324/392, 324/384, 123/426, 123/630, 123/644, 123/417, 123/198DC, 123/425, 73/118.1, 73/118.3, 73/117.3, 73/116, 73/119A, 340/945, 340/973

PRIOR-ART-DISCLOSED:

U.S. PATENT DOCUMENTS

Search Selected Search ALL Clear

PAT-NO	ISSUE-DATE	PATENTEE-NAME	US-CL

☐	Re28904	July 1976	Maisonville	324/392
☐	3886450	May 1975	Trussell et al.	324/170
☐	3965669	June 1976	Larson et al.	368/9
☐	4135246	January 1979	McMannis	364/431.02
☐	4192179	March 1980	Yelke	73/119A
☐	4207611	June 1980	Gordon	364/424.03
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☐	4437538	March 1984	Wilson	324/642
☐	4551803	November 1985	Hosaka et al.	364/431.05
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☐	4575809	March 1986	Sinniger et al.	364/569
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☐	4812768	March 1989	Quinn	364/551.01
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☐	4975846	December 1990	Abe et al.	364/424.03
☐	5001431	March 1991	Garasimowicz et al.	324/393
☐	5003478	March 1991	Kobayashi et al.	364/424.03
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☐	5151654	September 1992	Krzywicki et al.	324/160
☐	5160892	November 1992	Makhija et al.	364/431.03
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☐	5222469	June 1993	Sutton	123/198DC
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☐	5307017	April 1994	Mamyoma et al.	324/402
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☐				
☐	5337003	August 1994	Carmichael et al.	324/402
☐	5397860	March 1995	Yochum et al.	174/113C

ART-UNIT: 234

PRIMARY-EXAMINER: Teska; Kevin

ASSISTANT-EXAMINER: Louis-Jacques; Jacques

ATTY-AGENT-FIRM: Cumpston & Shaw

ABSTRACT:

An engine monitor includes, in a self-contained preferably sealed unit, a spark sensor, inductively and capacitively coupled through the case to a spark pick up wire, a timer, and a running time detector, responsive to inputs from the spark pick up to provide total running time, job time, and service time metering. Preferably, storage means are included for storing maximum RPM and spark mode data, that is, data indicating the number of firings per RPM for the particular engine, as well as a preset service interval and one or more auxiliary timers.

28 Claims, 24 Drawing figures

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case and having an input terminal, located adjacent to an outside wall of the case, and responsive to electro-magnetic radiation produced when the spark plug is fired;

a clamp on an outside wall of the case including a channel for forming a loop at the end of an antenna wire close to the input terminal for capacitively coupling a spark signal from the antenna wire through the case to the input terminal; and

a clock within the case, responsive to the spark detector for accumulating running time while the engine is running.

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case of the engine monitor 10. A spark plug pick up wire, or antenna wire 36 has one end having several turns 38 wrapped around the spark plug wire 20 and another end mechanically fastened to a clamp 40 on the outside of the engine monitor case and inductively and capacitively coupled to a spark pick up terminal within the case. In a non-secure or temporary installation, the pick up wire 36 may be secured to the spark plug wire in any conventional fashion such as through the use of tape or a clamp or the like. In a secure installation where the engine monitor 10 is used to measure operating time for billing purposes or the like, the spark pick up wire 36 is preferably secured to the spark plug wire 20 with a tamper evident attachment.

Detailed Description Text (11):
FIG. 6 and Box 6 show the components for implementing the job time reset function of the invention, as will be described in more detail later. The job time reset functional allows an external controller that includes an electro-magnetic oscillator, for example, to be brought into proximity with the engine monitor for resetting the job time. A tuned circuit including an inductor 120 and a capacitor 122 is responsive to a signal produced by the electromagnetic oscillator. A detector including a diode 124 and a capacitor 126 are connected to the circuit and a zener diode 128 limits the voltage produced by the circuit before applying it to an input 130 of the micro controller. In this way a signal is produced when the external oscillator is brought into close proximity with the engine monitor. A pull down resistor 132 keeps input 130 low unless a reset signal is present.

Detailed Description Text (16):
Optionally, total time function may include an error code display function that is designed not to be inadvertently accessed by the user. If the button 160 is pressed and held for more than 10 seconds, the display of the engine monitor shows a code indicating either normal operation or one or more preselected error conditions. This allows malfunctions of the engine monitor to be diagnosed either when the monitor is returned to the factory, or in an appropriate circumstance remotely by instructing a user as to entering the error mode.

Detailed Description Text (21):
From the RPM mode by pressing and releasing the button in less than three seconds, the job time mode 400 is entered. The job time mode displays elapsed ruing time since the last time the job time was reset. Two options are available for resetting job time. If a job guard jumper is enabled at the factory, a job guard signal must be provided to reset the job time. If the engine monitor is not configured in a job guard configuration, the user may reset the job time by button presses alone.

Detailed Description Text (22):
When in the job time mode, if the button is held for more than three seconds, the monitor senses whether the job guard jumper 410 is installed. If not, the job time is set to 0 430. When the button is released the monitor reverts to the job time mode. If a jumper is installed to configure the monitor in a job guard configuration, when the button is held for more than three seconds the monitor determines whether a job guard input is present 420 If it is, the job time is reset 430 to 0, as in the mode just discussed. If no job guard input is present, the monitor simply reverts to the job time mode 400 and job time continues to accumulate as long as the engine is running.

CLAIMS:

1. An engine monitor for an internal combustion engine having at least one spark plug comprising:

a substantially weather resistant case;

a spark detector within the case capacitively coupled to the engine through the

Hit List

First Hit | Clear | Generate Collection | Print | Fwd Refs | Bkwd Refs | Generate OACS

Search Results - Record(s) 1 through 4 of 4 returned.

☑ 1. Document ID: US 5056023 A

Using default format because multiple data bases are involved.

L16: Entry 1 of 4 File: USPT Oct 8, 1991

US-PAT-NO: 5056023
DOCUMENT-IDENTIFIER: US 5056023 A

TITLE: Diagnosis system for motor vehicle

DATE-ISSUED: October 8, 1991

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Abe; Kunihiro	Tokyo			JP

US-CL-CURRENT: 701/32; 340/439, 701/99, 73/117.3

Full | Title | Citation | Front | Review | Classification | Date | Reference | Claims | KWIC | Draw D

☐ 2. Document ID: US 5038289 A

L16: Entry 2 of 4 File: USPT Aug 6, 1991

US-PAT-NO: 5038289
DOCUMENT-IDENTIFIER: US 5038289 A

TITLE: Diagnosis system for a motor vehicle

Full | Title | Citation | Front | Review | Classification | Date | Reference | Claims | KWIC | Draw D

☐ 3. Document ID: US 5034889 A

L16: Entry 3 of 4 File: USPT Jul 23, 1991

US-PAT-NO: 5034889
DOCUMENT-IDENTIFIER: US 5034889 A

TITLE: Diagnosis system for a motor vehicle

Full | Title | Citation | Front | Review | Classification | Date | Reference | Claims | KWIC | Draw D

☐ 4. Document ID: US 5003476 A

L16: Entry 4 of 4 File: USPT Mar 26, 1991

US-PAT-NO: 5003476
DOCUMENT-IDENTIFIER: US 5003476 A

TITLE: Diagnostic system for a motor vehicle

Full | Title | Citation | Front | Review | Classification | Date | Reference | Claims | KWIC

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L16: Entry 1 of 4 File: USPT Oct 8, 1991

US-PAT-NO: 5056023
DOCUMENT-IDENTIFIER: US 5056023 A

TITLE: Diagnosis system for motor vehicle

DATE-ISSUED: October 8, 1991

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Abe; Kunihiro	Tokyo			JP

ASSIGNEE-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY	TYPE CODE
Fuji Jukogyo Kabushiki Kaisha	Tokyo			JP	03

APPL-NO: 07/423779 [PALM]
DATE FILED: October 18, 1989

FOREIGN-APPL-PRIORITY-DATA:

COUNTRY	APPL-NO	APPL-DATE
JP	63-266308	October 21, 1988

INT-CL: [05] G01M 15/00, G06F 15/20

US-CL-ISSUED: 364/424.03; 364/431.01, 73/117.3, 340/439
US-CL-CURRENT: 701/32; 340/439, 701/99, 73/117.3

FIELD-OF-SEARCH: 364/424.01, 364/424.03, 364/424.04, 364/550, 364/551.01, 364/431.01, 364/431.04, 364/431.12, 73/117.2, 73/117.3, 340/438, 340/439, 340/459

PRIOR-ART-DISCLOSED:

U.S. PATENT DOCUMENTS

Search Selected Search ALL Clear

	PAT-NO	ISSUE-DATE	PATENTEE-NAME	US-CL
☐	4894781	January 1990	Sato et al.	364/551.01
☐	4899338	February 1990	Wroblewski	340/459
☐	4924391	May 1990	Hirano et al.	364/551.01

ART-UNIT: 234

PRIMARY-EXAMINER: Chin; Gary

ATTY-AGENT-FIRM: Beveridge, DeGrandi & Weilacher

ABSTRACT:

There is disclosed a diagnosis system for a motor vehicle, and comprising a plurality of and various electronic control units mounted on the vehicle, and a diagnosis unit connected to the control units and for diagnosing troubles occurring in the several control units. The system further comprises a plurality of communication circuits provided in the diagnosis unit corresponding to every communication systems of the control units, a communication bus provided to connect the control units in parallel to the diagnosis unit, and one external connector for connecting the bus to the diagnosis unit. Accordingly, it is possible for the system to respond to every trouble of the control unit despite different communication systems, without changing connectors, and providing a plurality of communication buses.

7 Claims, 11 Drawing figures

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L16: Entry 2 of 4 File: USPT Aug 6, 1991

US-PAT-NO: 5038289
DOCUMENT-IDENTIFIER: US 5038289 A

TITLE: Diagnosis system for a motor vehicle

DATE-ISSUED: August 6, 1991

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Abe; Kunihiro	Higashimurayama			JP

ASSIGNEE-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY	TYPE CODE
Fuji Jukogyo Kabushiki Kaisha	Tokyo			JP	03

DISCLAIMER DATE: 20080326

APPL-NO: 07/330593 [PALM]
DATE FILED: March 28, 1989

FOREIGN-APPL-PRIORITY-DATA:

COUNTRY	APPL-NO	APPL-DATE
JP	63-083469	April 4, 1988

INT-CL: [05] G01M 15/00, F02D 41/26, F02P 17/00

US-CL-ISSUED: 364/431.01; 73/117.2, 364/551.01
US-CL-CURRENT: 701/99; 702/183, 73/117.2

FIELD-OF-SEARCH: 364/431.01, 364/424.03, 364/551.01, 73/116, 73/117.2, 73/117.3, 73/119R, 73/119A

PRIOR-ART-DISCLOSED:

U.S. PATENT DOCUMENTS

Search Selected Search ALL Clear

	PAT-NO	ISSUE-DATE	PATENTEE-NAME	US-CL
☐	4527424	July 1985	Takahashi	73/119A
☐	4694408	September 1987	Zaleski	364/551.01
☐	4748843	June 1988	Schafer et al.	73/117.3

☐ 4757463 July 1988 Ballou et al. 364/551.01

FOREIGN PATENT DOCUMENTS

FOREIGN-PAT-NO	PUBN-DATE	COUNTRY	CLASS
58-12848	January 1983	JP	364/551.01

ART-UNIT: 234

PRIMARY-EXAMINER: Gruber; Felix D.

ATTY-AGENT-FIRM: Farber; Martin A.

ABSTRACT:

A diagnosis system for diagnosing an electronic control system mounted on a vehicle has a signal transmitter for transmitting a data demand signal and a signal demanding termination of transmission of the data. The electronic control system has a signal receiver for receiving the data demand signal and the transmission terminating demand signal from the diagnosis device, and an interpreter for interpreting the content of the received signals and a signal transmitter for transmitting an output signal to the diagnosis device in accordance with the interpretation.

2 Claims, 13 Drawing figures

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L16: Entry 3 of 4 File: USPT Jul 23, 1991

US-PAT-NO: 5034889
DOCUMENT-IDENTIFIER: US 5034889 A

TITLE: Diagnosis system for a motor vehicle

DATE-ISSUED: July 23, 1991

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Abe; Kunihiro	Higoshimuroyama			JP

ASSIGNEE-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY	TYPE CODE
Fuji Jukogyo Kabushiki Kaisha	Tokyo			JP	03

APPL-NO: 07/327518 [PALM]
DATE FILED: March 21, 1989

FOREIGN-APPL-PRIORITY-DATA:

COUNTRY	APPL-NO	APPL-DATE
JP	63-077642	March 29, 1988

INT-CL: [05] G06F 11/30, G06F 15/74

US-CL-ISSUED: 364/424.04; 73/117.3, 364/424.03
US-CL-CURRENT: 701/35; 701/33, 73/117.3

FIELD-OF-SEARCH: 364/424.03, 364/424.04, 364/431.01, 364/424.01, 307/9.1, 307/10.1, 73/117.2, 73/117.3

PRIOR-ART-DISCLOSED:

U.S. PATENT DOCUMENTS

Search Selected Search ALL Clear

	PAT-NO	ISSUE-DATE	PATENTEE-NAME	US-CL
☐	4694408	September 1987	Zaleski	364/424.03
☐	4748843	June 1988	Schafer et al.	73/117.3
☐	4757463	July 1988	Ballou et al.	364/551.01
☐	4760275	July 1988	Sato et al.	307/10.1
☐	4787041	November 1988	Yount	364/424.03

☐ 4796206 January 1989 Boscove et al. 364/551.01

FOREIGN PATENT DOCUMENTS

FOREIGN-PAT-NO	PUBN-DATE	COUNTRY	CLASS
60-25974	February 1985	JP	

ART-UNIT: 234

PRIMARY-EXAMINER: Black; Thomas G.

ATTY-AGENT-FIRM: Farber; Martin A.

ABSTRACT:

A system for diagnosing electronic control systems mounted in a motor vehicle has a signal receiver for receiving a data demand signal from a diagnosis device, an interpreter for interpreting a content of the received data demand signal and a signal transmitter for transmitting an output signal to the diagnosis device in accordance with the interpretation. A signal receiving line connects all of the signal receivers with each other in parallel, and a signal transmitting line connects all of the signal transmitters with each other in parallel. The signal receiving line and signal transmitting line are connected with the diagnosis device by a connector.

8 Claims, 9 Drawing figures

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L16: Entry 3 of 4 File: USPT Jul 23, 1991

US-PAT-NO: 5034889
DOCUMENT-IDENTIFIER: US 5034889 A

TITLE: Diagnosis system for a motor vehicle

DATE-ISSUED: July 23, 1991

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Abe; Kunihiro	Higoshimuroyama			JP

ASSIGNEE-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY	TYPE CODE
Fuji Jukogyo Kabushiki Kaisha	Tokyo			JP	03

APPL-NO: 07/327518 [PALM]
DATE FILED: March 21, 1989

FOREIGN-APPL-PRIORITY-DATA:

COUNTRY	APPL-NO	APPL-DATE
JP	63-077642	March 29, 1988

INT-CL: [05] G06F 11/30, G06F 15/74

US-CL-ISSUED: 364/424.04; 73/117.3, 364/424.03
US-CL-CURRENT: 701/35; 701/33, 73/117.3

FIELD-OF-SEARCH: 364/424.03, 364/424.04, 364/431.01, 364/424.01, 307/9.1, 307/10.1, 73/117.2, 73/117.3

PRIOR-ART-DISCLOSED:

U.S. PATENT DOCUMENTS

	PAT-NO	ISSUE-DATE	PATENTEE-NAME	US-CL
☐	4694408	September 1987	Zaleski	364/424.03
☐	4748843	June 1988	Schafer et al.	73/117.3
☐	4757463	July 1988	Ballou et al.	364/551.01
☐	4760275	July 1988	Sato et al.	307/10.1
☐	4787041	November 1988	Yount	364/424.03

FOREIGN PATENT DOCUMENTS

FOREIGN-PAT-NO	PUBN-DATE	COUNTRY	CLASS
60-25974	February 1985	JP	

ART-UNIT: 234

PRIMARY-EXAMINER: Black; Thomas G.

ATTY-AGENT-FIRM: Farber; Martin A.

ABSTRACT:

A system for diagnosing electronic control systems mounted in a motor vehicle has a signal receiver for receiving a data demand signal from a diagnosis device, an interpreter for interpreting a content of the received data demand signal and a signal transmitter for transmitting an output signal to the diagnosis device in accordance with the interpretation. A signal receiving line connects all of the signal receivers with each other in parallel, and a signal transmitting line connects all of the signal transmitters with each other in parallel. The signal receiving line and signal transmitting line are connected with the diagnosis device by a connector.

8 Claims, 9 Drawing figures

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L64: Entry 1 of 1 File: USPT Jul 1, 1997

DOCUMENT-IDENTIFIER: US 5644491 A
TITLE: Self contained multi-function engine monitor and timer for providing engine running time, job time, service time and tachometer functions

Application Filing Date (1):
19940131

Brief Summary Text (4):
Sophisticated engine monitoring systems are increasingly commonly employed, not only in large expensive vehicles such as airplanes, but more and more in ordinary passenger vehicles, such as cars and trucks. U.S. Pat. No. 5,257,190 describes an engine management system for powered vehicles that senses a large number of parameters of the engine powered vehicle and performs real time management for identifying system inefficiencies and sub-systems requiring repair. The device includes a microprocessor and an analogue to digital converter connected between a plurality of inputs and the microprocessor to convert the analogue output of input sensors into digital output for the microprocessor. A large number of direct real time inputs is described including RPM and the system includes a clock for implementing timing functions.

Brief Summary Text (5):
U.S. Pat. No. 4,853,859 shows a device for detecting operating conditions of a vehicle. The apparatus measures RPM and includes a clock for discriminating the entire working time of an engine into engine idling, operation of the vehicle and rest time.

Brief Summary Text (9):
There is a need for a low cost, after-market engine monitor to provide certain basic functions, such as RPM and timing functions. There is a large number of engine driven vehicles and apparatus in existence that have no built in monitoring functions. When these devices are routinely operated by a number of different people, especially in a rental environment, it is difficult to accurately monitor the operation of the engine so that preventive maintenance can be performed in a timely manner. In addition, especially in a rental environment, it is desirable to provide a means for monitoring the running time of an engine, so as to more fairly apportion rental charges based on running time, instead of time of possession. Still further, it is desirable to monitor maximum engine RPM to determine whether an engine has been operated beyond its safe operating range, redline.

Detailed Description Text (2):
FIG. 1 shows an engine monitor 10 in accordance with this invention installed on a portable air compressor 12. The compressor is powered by a conventional internal combustion engine 14 having a spark plug 16 disposed in a cylinder 18 for driving the compressor. The spark plug 16 is connected to a conventional spark coil or magneto, not shown, by a spark plug wire 20 leading to a removable cap 22 that engages the spark plug 16. The engine monitor 10, shown in an enlarged view at FIG. 2, is mechanically attached to the compressor by conventional fasteners 24, 26 such as bolts, extending through two mounting lugs 30, 32 integrally formed with the

L48: Entry 1 of 1 File: USPT Feb 5, 2002

US-PAT-NO: 6343617
DOCUMENT-IDENTIFIER: US 6343617 B1

TITLE: System and method of operation of a digital mass flow controller

DATE-ISSUED: February 5, 2002

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Tinsley; Kenneth E.	Plano	TX		
Tariq; Faisal	Plano	TX		

ASSIGNEE-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY	TYPE CODE
Millipore Corporation	Bedford	MA			02

APPL-NO: 09/350744 [PALM]
DATE FILED: July 9, 1999

PARENT-CASE:
RELATED APPLICATIONS This application is related to U.S. patent application Ser. No. 09/350,747 entitled "System and Method for Sensor Response Linearization," filed Jul. 9, 1999 by Thomas Pattantyus, et. al. This application is related to U.S. patent application Ser. No. 09/350,746 filed on Jul. 9, 1999, by D. S. Larson et al., entitled "Improved Mass Flow Sensor Interface Circuit". This application is related to U.S. patent application Ser. No. 09/351,120 filed on Jul. 10, 1999, by E. Vyers, entitled "System and Method for a Digital Mass Flow Controller." This application is related to U.S. patent application Ser. No. 09/351,098 filed on Jul. 10, 1999, by E. Vyers, entitled "System and Method for a Variable Gain Proportional-Integral (PI) Controller." This application is related to U.S. patent application Ser. No. 09/351,111 filed on Jul. 10, 1999, by T. T. Pattantyus, entitled "Method and System for Driving a Solenoid."

INT-CL: [07] G05 D 7/06

US-CL-ISSUED: 137/486; 137/487.5
US-CL-CURRENT: 137/486; 137/487.5

FIELD-OF-SEARCH: 137/486, 137/487.5

PRIOR-ART-DISCLOSED:

U.S. PATENT DOCUMENTS

	PAT-NO	ISSUE-DATE	PATENTEE-NAME	US-CL
☐	5062446	November 1991	Anderson	
☐	5660207	August 1997	Mudd	137/599
☐	5765283	June 1998	Mudd	29/890
☐	5850850	December 1998	Mudd	137/486
☐	5911238	June 1999	Bump et al.	
☐	5944048	August 1999	Bump et al.	

FOREIGN PATENT DOCUMENTS

FOREIGN-PAT-NO	PUBN-DATE	COUNTRY	CLASS
0 110 325	June 1984	EP	
0 834 723	October 1996	EP	

ART-UNIT: 3753

PRIMARY-EXAMINER: Michalsky; Gerald A.

ATTY-AGENT-FIRM: Gray, Cary Ware & Freidenrich, LLP

ABSTRACT:

The mass flow controller of the present invention includes a sensor. This sensor is used to detect a mass flow within a gas line. Additionally, this sensor provides an output to an electronic control system coupled to the sensor. The electronic control system will determine an expected mass flow based on the output of the sensor. The electronic control system will adjust a control valve with a control signal to regulate a first gas flow through the control valve.

10 Claims, 7 Drawing figures

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L27: Entry 1 of 1 File: USPT Oct 8, 1991

DOCUMENT-IDENTIFIER: US 5056023 A
TITLE: Diagnosis system for motor vehicle

Detailed Description Text (13):
The keyboard 32 is connected to an input side of the I/O interface 40, while the indicator 30 and display 31 are connected to an output side of the interface 40. The interface 40 receives various control signals output from the output interfaces 501e to 504e and the output signals from various sensors and switches. A diagnosis for trouble is performed by displaying data in the display 31 after processing. Light emitting diodes (LEDs) D.sub.1 to D.sub.10 of the indicator 30 are lit (or turned on or off) according to the signals of various switches so that it is possible to confirm operation of the switches.

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L19: Entry 1 of 1 File: USPT Oct 8, 1991

DOCUMENT-IDENTIFIER: US 5056023 A
TITLE: Diagnosis system for motor vehicle

Abstract Text (1):
There is disclosed a diagnosis system for a motor vehicle, and comprising a plurality of and various electronic control units mounted on the vehicle, and a diagnosis unit connected to the control units and for diagnosing troubles occurring in the several control units. The system further comprises a plurality of communication circuits provided in the diagnosis unit corresponding to every communication systems of the control units, a communication bus provided to connect the control units in parallel to the diagnosis unit, and one external connector for connecting the bus to the diagnosis unit. Accordingly, it is possible for the system to respond to every trouble of the control unit despite different communication systems, without changing connectors, and providing a plurality of communication buses.

Brief Summary Text (5):
However, the motor vehicle has a plurality of control units for controlling an engine, a transmission, a brake, and a steering mechanism. In the case of diagnosing troubles in the control units, a connector of the diagnosis system must be connected one by one to connectors of the control units, and the diagnosis operation is complicated. Furthermore, in the case of diagnosing troubles influencing a plurality of control units, the diagnosis operation is difficult and it takes much time in order to find the trouble. In order to solve problems, the applicant of the present invention has already proposed a diagnosis system comprising a diagnosis unit for finding troubles in the vehicle, a communication bus consisting of a transmitting line and a receiving line, a plurality of control units connected to the communication bus, and a connector provided at an end of the bus for connecting the control units to the diagnosis unit. And the diagnosis system performs a communication between the control units and the diagnosis unit through one connector.

Brief Summary Text (7):
Therefore, the control units having the same communication system are capable of being connected to the diagnosis system by one connector. But, it is problem that the diagnosis system needs some connectors corresponding to every communication system when one vehicle has a plurality of the control units respectively having different communication systems.

Brief Summary Text (9):
An object of the present invention is to provide a diagnosis system capable of accurately diagnosing a plurality of electronic control units and sensors connected thereto in a short time and improving the work efficiency in dependency on the interconnection of a diagnosis unit and a plurality of electronic control units, by only one connector.

Brief Summary Text (11):
The external connector connects the bus to the diagnosis unit so that communication

corresponding to the different communication systems is capable of diagnosing troubles occurring in the control units of different communication systems.

Detailed Description Text (9):
The communication bus 24a is connected to an external connector 24 which is connected to an input/output connector 26 of a diagnosis unit 25 via an adapter harness 27.

Detailed Description Text (11):
The controller 28 comprises a CPU 36, a RAM 37, a timer 38 such as a frequency counter and an input/output (I/O) interface 40 which are interconnected to each other, and a memory cartridge 34 externally connectable through a connector 33.

Detailed Description Text (12):
The I/O interface 40 is connected to the input/output connector 26 for transmitting a signal T.sub.x to the bus 24a, for receiving a signal R.sub.x from the bus 24a and for selectively outputting a clock signal CLK. The signal CLK is generated by frequency dividing of an output from a clock pulse oscillating element 42 provided in the timer 38 and generating a synchronous signal. In a clock synchronous communication system, data are transmitted and received in synchronization with the clock signal CLK.

Detailed Description Text (19):
The diagnosis unit 25 comprises communication circuits 56a and 56b, a data calculation circuit 57, a keyboard interpretation circuit 58, a display drive circuit 59, the keyboard 32, and the display 31. The communication circuit 56a has a transmission line and reception line connected to the input/output connector 26, while the communication circuit 56b has a transmission line, a reception line and a clock signal line connected to the input/output connector 26.

Detailed Description Text (27):
Before performing a program, the input/output connector 26 of the diagnosis unit 25 is connected to the external connector 24 of the vehicle 500 directly or through the adapter harness 27.

Detailed Description Text (57):
Accordingly, even though the engine control unit such as the ECU 501, the transmission control unit such as the ECU 502, the brake control unit such as the ECU 503, and the cruise control unit such as the ECU 504 have different communication systems, respectively, such as the start-stop synchronous system and the clock synchronous system corresponding to the difference of the processing ability, it is possible to diagnose the troubles corresponding to each communication system of the ECUs only by the connection between one external connector 24 and the diagnosis unit 25, and by input operation of the diagnosis mode through the keyboard 32. Therefore, it is possible to systematically diagnose the troubles common to the several units.

Detailed Description Text (58):
As aforementioned in detail, the diagnosis system according to the present invention comprises a plurality of electronic control units having different communication systems and a communication bus for interconnecting between the control units and the diagnosis unit in parallel, and one external connector provided to the bus, so that it is possible to diagnose the troubles of the vehicle by only connecting the external connector to the diagnosis unit without a plurality of communication buses to every communication systems. Namely, it is unnecessary to attach and remove the connector at every change of the communication systems, thereby facilitating diagnosis the control units having different communication systems. Accordingly, workability is extremely improved and it is easy to diagnose the troubles related to control units having different communication systems.

Detailed Description Text (59):
Furthermore, it is unnecessary to provide external connectors for every communication system of the control units and only one external connector may connect the diagnosis unit with every control unit, so that the number of parts is decreased and it is possible to reduce the production cost.

CLAIMS:

1. A diagnosis system for a motor vehicle, having sensing means for sensing operating conditions of the vehicle as input data, a plurality of electronic control units being responsive to the input data from the sensing means for providing output data for controlling the vehicle, independently, a diagnosis unit for sending a demand signal demanding specific data of the input and output data to the electronic control units for diagnosing the specific data and connecting means provided with a bus and a connector for connecting the diagnosis unit to the electronic control units in parallel to communicate bidirectionally, comprising:

a clock signal line connecting the diagnosis unit to at least one of the electronic control units to transmit a clock signal therebetween;

first communication means for transmitting the demand signal and the specific data between the diagnosis unit and said at least one of the electronic control units in a clock synchronous communication in synchronous to said clock signal;

second communication means for transmitting the demand signal and the specific data in a start-stop synchronous communication through the connecting means between the diagnosis unit and the other of the electronic control units;

a keyboard for inputting into the diagnosis unit a diagnosis mode designating an unit to be accessed of the electronic control units; and

interpretation means for interpretating said designated unit from said diagnosis mode and for selecting one of said first and second communication means matching said designated unit so as to perform every diagnosis item dependent on different communication types at one time without disconnecting the connector.

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L18: Entry 1 of 1 File: USPT Oct 8, 1991

DOCUMENT-IDENTIFIER: US 5056023 A
TITLE: Diagnosis system for motor vehicle

Brief Summary Text (3):
In conventional technology, the electronic control units control various amounts such as an air-fuel ratio by using a microcomputer. Ordinally, the units have a self-diagnosis function for indicating troubles by lighting or turning on and off a self-diagnosis lamp when trouble occurs in sensors or actuators.

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L21: Entry 1 of 1 File: USPT Oct 8, 1991

DOCUMENT-IDENTIFIER: US 5056023 A
TITLE: Diagnosis system for motor vehicle

Detailed Description Text (7):
The ECU 504 receives several signals via the input interface 504g from a speed set switch SW7 and the vehicle speed sensor 13, then controls a throttle actuator 530 to run the vehicle in constant speed via the output interface 504e and a driver 504h. When the ECU 504 receives several signals from the brake switch SW6, accelerator switch SW5, neutral switch SW3, deceleration switch SW8, and a resume switch SW9 via the input interface 504g, the ECU 504 removes the control of the constant speed running or reset a constant speed running after charging the speed of the vehicle.

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L24: Entry 1 of 2 File: USPT Aug 4, 1998

DOCUMENT-IDENTIFIER: US 5790965 A
TITLE: Diagnosis system applicable to several types of electronic control units for motor vehicles

Abstract Text (1):
A diagnosis system has a main circuit for executing diagnosis by data communication with an electronic control unit installed in a vehicle using data read out of the control unit. The system has an interface circuit that converts input and output signal levels on the main circuit sent from and to the control unit into signal levels that match signal levels in the control unit. The interface circuit has a comparator and a transistor. A signal sent from the control unit and pulled up with a supply voltage supplied to the control unit is applied to the comparator at its inverting input terminal. A reference signal based on the supply voltage is also applied to the comparator at its non-inverting input terminal. An output signal of the comparator is applied to the main circuit. The transistor is supplied with the supplied voltage via a resistor at its collector. The transistor receives at its base an output signal of the main circuit. A signal appearing at the collector is applied to the control unit. The system also has a switch provided on the main circuit. A supply voltage supplied to the interface circuit is switched between the supply voltage supplied to the control unit and a supply voltage supplied to the main circuit.

Application Filing Date (1):
19951108

DATE ISSUED (1):
19980804

INVENTOR (1):
Abe; Kunihiro

Inventor Group (1):
Abe; Kunihiro Higashi-Murayama JP

Brief Summary Text (2):
The present invention relates to a diagnosis system for a vehicle with data read out of an electronic control unit installed in the vehicle. Particularly, this invention relates to a diagnosis system applicable to several kinds of electronic control units that operate on different signal levels.

Brief Summary Text (3):
Recently, an electronic control unit of an automobile has become more complicated. What is essential for diagnosing such vehicles is the diagnosis system that can easily read out data of electronic control units installed in the vehicles.

Brief Summary Text (4):
This diagnosis system is mainly designed for portability and general purposes. A car mechanic thus can easily check the control system of the automobile. Most diagnostic systems are equipped with a memory cartridge detachable to the system. The memory cartridge contains a recording medium that stores diagnostic programs

corresponding to kinds, types of automobiles manufactured in specific years, etc. The diagnostic system with the memory cartridge makes data communication with the electronic control unit in the automobile with the data read therefrom. Such a system, or diagnosis equipment is disclosed by Japanese Patent Laid-Open No. 1-210844.

Brief Summary Text (5):
There are many kinds of electronic control units installed in automobiles. These units employ different kinds of communications systems and communications interfaces. Car manufacturers provide electronic control units that operate on different signal levels for many kinds of automobiles. These situations force repair shops to prepare any diagnosis equipment with hardware applicable to different signal levels for each manufacturer or type of an electronic control unit. Preparing the equipment for each communications system is economically very hard for the repair shops.

Brief Summary Text (6):
To solve such a problem, Japanese Patent Laid-Open No. 3-111733 discloses signal converting adapters detachable to a data processing circuit in diagnosis equipment. This makes exchangeable a circuit portion of the diagnostic equipment for data communication with a control system of an automobile.

Brief Summary Text (7):
However, one kind of diagnosis equipment requires several additional pieces of hardware. This results in a higher total production cost. Further, this causes mis-diagnosis at a repair shop due to erroneous attachment of additional hardware for data communication to the diagnosis equipment. Such erroneous attachment often occurs when exchanging diagnostic programs for different kinds of automobiles, types of automobiles manufactured in specific years, etc.

Brief Summary Text (9):
An object of the present invention is to provide a diagnosis system suitable for any electronic control units with different signal levels installed in vehicles.

Brief Summary Text (10):
According to the present invention, there is provided a diagnosis system for a motor vehicle having various sensors for detecting operating conditions of the vehicle and for generating vehicle operating signals, an electronic control unit responsive to the vehicle operating signals for controlling the vehicle and for producing control signals, various actuators and indication lumps responsive to the control signals for operating the vehicle in an optimum condition corresponding to each of the operating conditions, the system reading out data in the electronic control unit and for transmitting the data and further having diagnosing means responsive to the control signals for diagnosing the electronic control unit by comparing the transmitted data with normal data stored in a memory, and a memory cartridge detachable to the diagnosing means, for storing various diagnosis programs and communication protocols, the diagnosis system comprising: a first interface circuit provided in a memory cartridge and directly connected to the electronic control unit for matching a logic function corresponding to each control signal and for generating a communications signal; memory means for storing various kinds of logic programs; an in-system programmer responsive to the communications signal for controlling the memory means by reprogramming logical functions of the first circuit with design information so as to precisely diagnose the vehicle at a high speed without changing the memory cartridge for various types of the electronic unit; and a second interface circuit interposed between the memory means and the memory cartridge for converting input and output signal levels sent from and to the electronic control unit into signal levels that match other signal levels in the electronic control unit.

Brief Summary Text (11):

The diagnosis system may further include a comparator with an inverting input terminal supplied with an input signal sent from the electronic control unit and pulled up with a supply voltage supplied to the electronic control unit and a non-inverting input terminal supplied with a reference signal based on the supply voltage, the comparator comparing the input and the reference signals to change the input signal into an output signal of the comparator that is applied to the diagnosing means; and a transistor with a base and a collector that is supplied with the supply voltage via resistor, an output signal of the diagnosing means applied to the base being changed into a signal appearing at the collector that is applied to the electronic control unit.

Brief Summary Text (12):
The diagnosis system may further include means for switching a supply voltage supplied to the second interface circuit between a first supply voltage supplied to the electronic control unit and a second supply voltage supplied to the diagnosing means. The switching means may include a jumper wire or wiring pattern for switching the supply voltage to the interface circuit between the first and second supply voltages.

Brief Summary Text (13):
The diagnosis system may further include a recording medium provided in the memory cartridge, for storing diagnosis programs executed by the diagnosing means.

Drawing Description Text (2):
FIG. 1 shows a front view of diagnosis equipment connected to an electronic control unit installed in an automobile, according to the present invention;

Drawing Description Text (3):
FIG. 2 shows circuit block diagrams of the electronic control unit and the diagnosis equipment as the first preferred embodiment according to the present invention;

Drawing Description Text (6):
FIG. 5 is a flowchart explaining the process of data communication and diagnosis in the first embodiment;

Drawing Description Text (7):
FIG. 6 shows circuit block diagrams of the electronic control unit and the diagnosis equipment as the second preferred embodiment according to the present invention; and

Drawing Description Text (8):
FIG. 7 is a flowchart explaining the process of data communication and diagnosis in the second embodiment, showing only the different portion from the process shown in FIG. 5.

Detailed Description Text (3):
FIG. 1 shows a front panel of a portable diagnosis equipment 100 according to the present invention. The diagnostic equipment 100 is connected to an electronic control unit 300 installed in an automobile 200 for diagnosis. Provided on the front panel are a liquid crystal display screen 30, an indicator 31 of light emitting diodes and a keyboard 32. An input/output connector 33 and a power switch 35 are provided on top of the diagnostic equipment 100. An adaptor harness 34 is extending from the input/output connector 33. A memory cartridge 60 is inserted in the lower part of the diagnostic equipment 100. The cartridge 60 will be described later.

Detailed Description Text (4):
To diagnose any fault occurring in the electronic control unit 300: first, connect the adaptor harness 34 to a connector 2a of the control unit 300; second, turn on

the power switch 35; third, enter specific keys on the keyboard 32; and lastly, execute diagnosis while looking at displays on the display screen 30.

Detailed Description Text (5):
The preferred embodiments employ an engine control unit (ECU) 2 to be diagnosed as the electronic control unit 300 as shown in FIG. 2. Besides engine control, the electronic control unit 300 may be used for: power train control of an engine, an automatic transmission, etc.; vehicle body control, such as air conditioning and several information guidance systems; vehicle control, such as suspension control and auto-cruising, etc.

Detailed Description Text (7):
Data signals applied to the input/output interface 7 are: a coolant temperature signal TW produced by a coolant temperature sensor 10; a lean/rich signal .lambda. of an air-fuel ratio produced by an oxygen sensor 11; an intake air quantity signal Q produced by an intake air sensor 12; an ON/OFF signal SWa of an air conditioner switch 13; a vehicle speed signal S produced by a speed sensor 14; an ON/OFF signal SW1 of an idle switch 15; a throttle signal Tr.theta. produced by a throttle sensor 16, the signal Tr.theta. representing how a throttle is opened or closed; an ON/OFF signal SWn of a neutral switch 17; and an engine speed signal N produced by an engine speed sensor 18.

Detailed Description Text (10):
Also connected to the driver 9 is a self-diagnostic indicator 24 for notifying faults when discovered by self-diagnostic function. The indicator 24 has a set of lamps which are flicked by predetermined times or turned on in a predetermined manner. These light indications respond to trouble codes read out of the ROM 4 and that correspond to fault portions.

Detailed Description Text (12):
The diagnosis equipment 100 is suitable for use at a repair shop in a car dealer, for instance. The diagnostic equipment 100 includes a controller 36 (microcomputer) and a voltage regulator 37. Connected to the voltage regulator 37 is the power switch 35 which is further connected to the battery V.sub.B via adapter harness 34. The detachable memory cartridge 60 with a ROM 61 is inserted into the controller 36 via connecter 38.

Detailed Description Text (13):
The controller 36 in the first preferred embodiment includes a CPU 40 as a main processor, a RAM 41, a timer 42 for generating a synchronizing signal, I/O interfaces 43 and 44, a communications interface (which will be described later). Via buses, these components and the ROM 61 of the memory cartridge 60 are connected to each other. The output signals of the sensors and switches of the ECU 2 are supplied to the I/O interface 43 via input/output interface 7. In response to the output signals, the I/O interface 43 generates signals to turn on the LEDs of the indicator 31. The LEDs indicate ON or OFF situations of the sensors and switches. A key entry on the keyboard 32 generates signals that are supplied to the I/O interface 44. The interface 44 generates signals that are supplied to the display screen 30.

Detailed Description Text (16):
Connected to the FPGA 45 at its input and output are a plurality of interface cells 51 one of which is shown in FIG. 4. The interface cells 51 are employed as an interface to adjust signal levels processed by the CPU 40. to those in the control system installed in an automobile. Data communication can be made between the control system on the automobile and diagnosis equipment 100 via interface cells 51. This is done even though the control systems installed in the automobile and the diagnostic equipment 100 are different in supplied voltage.

Detailed Description Text (18):

Further, a Schmitt-type hysterisis comparator is employed as the comparator 52 with a feedback resistor RF. Applied to its non-inverting input terminal is a reference voltage via resistor R3. The reference voltage is obtained by dividing the voltage Vcc of the control system by resistors R1 and R2. Applied to its inverting input terminal is a signal Ty from the control system installed in the automobile via resistor R5. The signal Ty is pulled up with the voltage Vcc via resistor R4. An open corrector output of the comparator 52 is supplied to the FPGA 45 of the diagnosis equipment 100 as a signal Rx as shown in FIG. 3.

Detailed Description Text (20):
A voltage of 5 volts is supplied from the voltage regulator 37 to the control system of the diagnosis equipment 100. This voltage is employed in general digital circuits. Most control systems on automobiles also employ a voltage of 5 volts as Vcc. However, some control systems on automobiles employ a voltage of 12 volts corresponding to the battery voltage V.sub.B. For such a voltage, the diagnostic equipment 100 includes two power lines 62 and 63 as shown in FIG. 2. The power line 62 carries a voltage of 12 volts from the battery V.sub.B. The power line 63 carries a voltage of 5 volts from the voltage regulator 37. Both lines are connected to the memory cartridge 60 via connector 38.

Detailed Description Text (21):
The memory cartridge 60 is to make the diagnosis equipment 100 flexible for general use, or applicable to different diagnostic items, car types, communications protocols, etc. For this purpose, the ROM 61 stores a diagnosis boot program for the CPU 40, a diagnostic program for an electronic control unit (ECU 2) of a specific automobile, and logical data for reprogramming the FPGA 45. The ROM 61 does not necessarily store the boot program. A read only memory storing the boot program may be installed in the controller 36.

Detailed Description Text (24):
FIG. 2 shows the case where the control system on the automobile employs a voltage of 12 volts as a supply voltage. The power line 62 is connected to the power line 65 via switch 64. The power line 62 can be connected to a power line of the voltage regulator 8 via switch 35 when the ECU 2 employs a voltage of 8 volts or another as a supplied voltage. The diagnosis equipment 100 is applicable to any control systems installed in automobiles when a supply voltage of the control system is within an operational voltage range of the interface cells 51.

Detailed Description Text (25):
To diagnose any faults, insert the memory cartridge 60 with the ROM 61 into the diagnosis equipment 100. The ROM 61 stores the diagnostic program for the engine control unit (ECU) 2 of a specific automobile and design data. The diagnostic equipment 100 is initialized and the design data stored in the ROM 61 is transferred to the FPGA 45. The FPGA 45 is reprogrammed with the design data to be applicable to the diagnostic program and communications protocol for the ECU 2 of the automobile 200. Communication between the ECU 2 and FPGA 45 is thus made possible.

Detailed Description Text (26):
The flowchart shown in FIG. 5 will describe the process of the diagnosis operation with the diagnosis equipment 100.

Detailed Description Text (27):
To execute the process: first, connect the diagnostic equipment 100 with the memory cartridge 60 to the ECU 2 via adapter harness 34; and next, turn on the power switch 35 to reset the CPU 40 that governs the entire system of the diagnosis equipment 100. The entire system is thus initialized (STEP S101).

Detailed Description Text (33):
When the CPU 40 receives the answer in STEP S107, the CPU 40 executes a diagnosis

program in STEP S108. While the program is running, a message representing that diagnosis is ready to start is displayed on the display screen 30. The process goes in key entry waiting mode.

Detailed Description Text (34):
To check a battery voltage, for example, an operator enters battery voltage diagnostic mode keys, such as "F", "0", "1", and "ENT" on the keyboard 32. This diagnostic mode is interpreted by the CPU 40 that transmits a request for battery voltage data to the ECU 2 via FPGA 45.

Detailed Description Text (35):
In reply to the request, the ECU 2 searches an address corresponding to the request in the RAM 5 to read out data. This data is transmitted to the diagnosis equipment 100.

Detailed Description Text (36):
On receiving, the diagnostic equipment 100 executes data processing, such as binary-to-decimal conversion. The processed result is displayed on the display screen 30. The operator checks the battery voltage through the display and continues diagnosing other items with corresponding key entry if desired.

Detailed Description Text (37):
As described above, the diagnosis equipment according to the first embodiment can be used for any electronic control units. The electronic control units may have different communications protocols with different data formats, transmission and reception timings, etc., and different signal levels. There is no need for preparing other diagnosis equipment with different hardware for communications protocols and signal levels of electronic control units. This results in highly efficient diagnosis operations.

Detailed Description Text (39):
Next, the second preferred embodiment of the diagnosis system according to the present invention will be explained.

Detailed Description Text (40):
As shown in FIG. 6, diagnosis equipment 100a has a switch 70 for switching power lines 62 (12 V) and 63 (5 V) and connecting the switched line to a power line. The switch 70 provided in the diagnostic equipment 100a corresponds to the switch 64 of the memory cartridge 60 in the first embodiment. Other components of the diagnostic equipment 100a are the same as those of the diagnostic equipment 100 in FIG. 2.

Detailed Description Text (41):
In the second embodiment, the control system of the diagnostic equipment 100a has a supply voltage of 5 volts and that of the ECU 2 has a supply voltage either of 5 or 12 volts. The power line 62 (12 V) is connected to a power line connected to the voltage regulator 8 of the ECU 2 via switch 35. This connection is made when the supply voltage on the ECU 2 side is not 12 volts.

Detailed Description Text (42):
A controller 36a of the diagnosis equipment 100a has a relay with two circuits as the switch 70 in FIG. 6. The two circuits are connected separately at their contacts to the power lines 62 (12 V) and 63 (12 V). Both other contacts of the circuits are connected to a power line 65 of the interface cells 51. A relay coil of the relay 70 is connected at its one end to the power line 63 (12 V). The relay coil is further connected at its other end to the I/O interface 43. The relay 70 is switched in response to the signal level of the communications system on the automobile to connect either of the power lines 62 (12 V) and 63 (12 V) to the power line 65 of the interface sells 51.

Detailed Description Text (43):

For this purpose, a ROM 61a of a memory cartridge 60a stores several programs for a CPU 40a and FPGA 45. The programs for the CPU 40a are a diagnostic boot program, a diagnostic program for the ECU 2 of a specific automobile, etc. The ROM 61a further stores data on a supply voltage supplied to the control system installed in automobile.

Detailed Description Text (44):
The flowchart shown in FIG. 7 will describe the process of data communication and diagnosis operation in the second embodiment. FIG. 7 only shows a part of the process including STEPS S110 to S114. STEPS S110 and S114 respectively correspond to STEPS S101 and S102 in FIG. 5. Other parts (not shown) of the process after STEP S114 in the second embodiment are the same as those after STEP S102 in FIG. 5. Further, the process will be described in FIG. 7 under the situation that the power line 63 (5 V) has been connected to the power line 65 of the interface cells 51 as shown in FIG. 6.

Detailed Description Text (48):
As described above, also the diagnosis equipment according to the second embodiment can be used for any electronic control units. The electronic control units may have different communications protocols with different data formats, transmission and reception timings, etc., and different signal levels. There is no need for preparing other diagnosis equipment with different hardware for communications protocols and signal levels of the electronic control units. This achieves highly efficient diagnostic operations and lower costs for production of the diagnosis equipment and diagnostic operations.

CLAIMS:

1. A diagnosis system selectively connected to an electronic control unit installed in a motor vehicle for data communication, comprising:

a memory,

a processor in association with the memory storing a diagnostic program for a particular type of car to be tested for issuing a request signal directed to the electronic control unit and processing a reply data signal transmitted from the electronic control unit in response to the request signal;

a plurality of interface cells interposed between the processor and the electronic control unit for converting a voltage level of the request signal from the processor to a voltage level of the electronic control unit and a voltage level of the reply data signal from the electronic control unit to a voltage level of the processor; and

switching means for switching a property of the interface cells so as to enable the diagnosis system to be used with electronic control units operating under different voltage levels.

2. The diagnosis system according to claim 1, wherein the switching means is installed in a detachable cartridge having the memory operatively connected to the processor, the switching means being formed to switch the property of the interface cells to match a voltage level of an electronic control unit mounted on the particular type of car.

3. The diagnosis system according to claim 1, wherein the switching means is a jumper wire.

4. The diagnosis system according to claim 1, wherein the switching means is a wiring pattern.

5. The diagnosis system according to claim 1, wherein the switching means is a relay.

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L24: Entry 1 of 2 File: USPT Aug 4, 1998

US-PAT-NO: 5790965
DOCUMENT-IDENTIFIER: US 5790965 A

TITLE: Diagnosis system applicable to several types of electronic control units for motor vehicles

DATE-ISSUED: August 4, 1998

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Abe; Kunihiro	Higashi-Murayama			JP

ASSIGNEE-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY	TYPE CODE
Fuji Jukogyo Kabushiki Kaisha	Tokyo			JP	03

APPL-NO: 08/554226 [PALM]
DATE FILED: November 8, 1995

FOREIGN-APPL-PRIORITY-DATA:

COUNTRY	APPL-NO	APPL-DATE
JP	6-279505	November 14, 1994

INT-CL: [06] G06 F 13/00

US-CL-ISSUED: 701/29; 307/10.1, 701/33
US-CL-CURRENT: 701/29; 307/10.1, 701/33

FIELD-OF-SEARCH: 364/423.098, 364/424.034, 364/424.038, 364/424.04, 364/550, 364/551.01, 395/500, 395/285, 395/286, 701/1, 701/29, 701/33, 701/35, 307/10.1, 340/428, 340/438, 340/439, 340/146.2

PRIOR-ART-DISCLOSED:

U.S. PATENT DOCUMENTS

	PAT-NO	ISSUE-DATE	PATENTEE-NAME	US-CL
☐	4831560	May 1989	Zaleski	364/551.01
☐	4962456	October 1990	Abe et al.	
☐	4975846	December 1990	Abe et al.	
	4975847	December 1990	Abe et al.	

☐				
☐	5003477	March 1991	Abe et al.	
☐	5132905	July 1992	Takai et al.	364/424.038
☐	5278759	January 1994	Berra et al.	364/423.098
☐	5416917	May 1995	Adair et al.	395/500
☐	5555498	September 1996	Berra et al.	364/424.038

ART-UNIT: 364

PRIMARY-EXAMINER: Zanelli; Michael

ASSISTANT-EXAMINER: Pipala; Edward

ATTY-AGENT-FIRM: Beveridge, DeGrandi, Weilacher & Young, LLP

ABSTRACT:

A diagnosis system has a main circuit for executing diagnosis by data communication with an electronic control unit installed in a vehicle using data read out of the control unit. The system has an interface circuit that converts input and output signal levels on the main circuit sent from and to the control unit into signal levels that match signal levels in the control unit. The interface circuit has a comparator and a transistor. A signal sent from the control unit and pulled up with a supply voltage supplied to the control unit is applied to the comparator at its inverting input terminal. A reference signal based on the supply voltage is also applied to the comparator at its non-inverting input terminal. An output signal of the comparator is applied to the main circuit. The transistor is supplied with the supplied voltage via a resistor at its collector. The transistor receives at its base an output signal of the main circuit. A signal appearing at the collector is applied to the control unit. The system also has a switch provided on the main circuit. A supply voltage supplied to the interface circuit is switched between the supply voltage supplied to the control unit and a supply voltage supplied to the main circuit.

5 Claims, 7 Drawing figures

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L24: Entry 2 of 2 File: USPT Apr 7, 1998

US-PAT-NO: 5737711
DOCUMENT-IDENTIFIER: US 5737711 A

TITLE: Diagnosis system for motor vehicle

DATE-ISSUED: April 7, 1998

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Abe; Kunihiro	Higashi-Murayama			JP

ASSIGNEE-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY	TYPE CODE
Fuji Jukogyo Kabuishiki Kaisha	Tokyo			JP	03

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DATE FILED: October 30, 1995

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JP	6-275349	November 9, 1994
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INT-CL: [06] G06 F 13/00, G06 F 17/40, G01 R 31/00

US-CL-ISSUED: 701/29; 701/33, 701/35, 701/551.01, 395/500, 395/680, 340/438, 340/439
US-CL-CURRENT: 701/29; 340/438, 340/439, 701/33, 701/35

FIELD-OF-SEARCH: 364/424.034, 364/424.035, 364/424.037, 364/424.038, 364/424.039, 364/424.04, 364/551.01, 364/580, 371/22.2, 340/438, 340/439, 324/73.1, 73/116, 73/117.2, 73/117.3, 395/500, 395/680, 395/682

PRIOR-ART-DISCLOSED:

U.S. PATENT DOCUMENTS

Search Selected Search ALL Clear

	PAT-NO	ISSUE-DATE	PATENTEE-NAME	US-CL
☐	4831560	May 1989	Zaleski	364/551.01
☐	4967143	October 1990	Raviglione et al.	324/73.1

☐	5056023	October 1991	Abe	364/424.037
☐	5107428	April 1992	Bethencourt et al.	364/424.04
☐	5278759	January 1994	Berra et al.	364/423.098
☐	5491418	February 1996	Alfard et al.	324/402
☐	5541840	July 1996	Gurne et al.	364/424.038
☐	5555498	September 1996	Berra et al.	364/424.038

ART-UNIT: 234

PRIMARY-EXAMINER: Nguyen; Tan Q.

ATTY-AGENT-FIRM: Beveridge, Degrandi, Weilacher & Young, LLP

ABSTRACT:

A diagnosis system conducts diagnosis with data read out of an electronic control unit with a communications protocol installed in a vehicle. The system has an integrated circuit to be an communications interface suitable for the protocol. The circuit can be made suitable for any communications protocol by reprogramming logical functions of the circuit with design information. Instead of such circuit, the system may have a main processor and a subprocessor. On one hand, the main processor conducts virtual data communication with the control unit for diagnosis. On the other hand, the subprocessor executes a communications processing program suitable for the protocol to have data communication with the control unit. The subprocessor receives data from the main processor and transfers the data to the control unit and vice versa for the virtual data communication.

8 Claims, 7 Drawing figures

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L24: Entry 2 of 2 File: USPT Apr 7, 1998

DOCUMENT-IDENTIFIER: US 5737711 A
TITLE: Diagnosis system for motor vehicle

Abstract Text (1):
A diagnosis system conducts diagnosis with data read out of an electronic control unit with a communications protocol installed in a vehicle. The system has an integrated circuit to be an communications interface suitable for the protocol. The circuit can be made suitable for any communications protocol by reprogramming logical functions of the circuit with design information. Instead of such circuit, the system may have a main processor and a subprocessor. On one hand, the main processor conducts virtual data communication with the control unit for diagnosis. On the other hand, the subprocessor executes a communications processing program suitable for the protocol to have data communication with the control unit. The subprocessor receives data from the main processor and transfers the data to the control unit and vice versa for the virtual data communication.

Application Filing Date (1):
19951030

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19980407

INVENTOR (1):
Abe; Kunihiro

Inventor Group (1):
Abe; Kunihiro Higashi-Murayama JP

Brief Summary Text (2):
The present invention relates to a diagnosis system for a vehicle with data read out of an electronic control unit installed in the vehicle. Particularly, this invention relates to a diagnosis system applicable to several kinds of protocols for data communication.

Brief Summary Text (3):
Recently, an electronic control of an automobile becomes more complicated. What is essential for diagnosing such vehicles is the diagnosis system that can easily read out data of electronic control units installed in the vehicles.

Brief Summary Text (4):
This diagnosis system is mainly designed for portability and general purposes. A car mechanic thus can easily check the control system of the automobile. Most diagnosis systems are equipped with a memory cartridge detachable to the system. The memory cartridge contains a recording medium that stores diagnosis programs corresponding to kinds, types of automobiles manufactured in specific years, etc. The diagnosis system with the memory cartridge makes data communication with the electronic control unit in the automobile with the data read therefrom. Such a system, or diagnosis equipment is disclosed by Japanese Patent Laid-Open No. 1-

210844.

Brief Summary Text (5):
There are many kinds of electronic control units installed in automobiles. These units employ different kinds of communications systems and interfaces. Car manufacturers provide different communications protocols for various kinds of automobiles. These situations force repair shops to prepare any diagnosis equipment with hardware applicable to different communications protocols for each car manufacturer or type of an electronic control unit. Preparing the equipment for each communications protocol is economically very hard for the repair shops.

Brief Summary Text (6):
To solve such a problem, Japanese Patent Laid-Open No. 3-111733 discloses signal converting adapters detachable to a data processing circuit in diagnosis equipment. This makes exchangeable a circuit portion of the diagnosis equipment for data communication with a control system of an automobile. The diagnosis equipment is thus made applicable to several kinds of communications protocols.

Brief Summary Text (7):
However, one kind of diagnosis equipment requires several additional hardware. This results in a higher total production cost. Further, this causes mis-diagnosis at a repair shop due to erroneous attachment of additional hardware for data communication to the diagnosis equipment. Such erroneous attachment often occurs when exchanging diagnosis programs for different kinds of automobiles, types of automobiles manufactured in specific years, etc.

Brief Summary Text (9):
An object of the present invention is to provide a diagnosis system suitable for any electronic control units with different communications protocols installed in vehicles without changing hardware.

Brief Summary Text (10):
According to the present invention, there is provided a diagnosis system for a motor vehicle, having various sensors for detecting operating conditions of the vehicle and for generating vehicle operating signals, an electronic control unit responsive to the vehicle operating signals for controlling the vehicle and for producing control signals, various actuators and indication lamps responsive to the control signals for operating the vehicle in an optimum condition corresponding to each of the operating conditions, the system reading out data in the electronic control unit and for transmitting the data and further having diagnosing means responsive to the control signals for diagnosing the electronic control unit by comparing the transmitted data with normal data stored in a memory, and a memory cartridge detachable to the diagnosing means, for storing various diagnosis programs and communications protocols, the diagnosis system comprising: an interface circuit provided in the memory cartridge and directly connected to the electronic control unit for matching a logic function corresponding to each control signal and for generating a communications signal; memory means for storing various kinds of logic programs; and an in-system programmer responsive to the communications signal for controlling the memory means by reprogramming logical functions of the circuit with design information so as to precisely diagnose the vehicle at a high speed without changing the memory cartridge for various types of the electronic unit.

Brief Summary Text (11):
The diagnosis system may further include a storage for storing various kinds of design information for reprogramming. The storage may be a volatile storage or an electronically erasable nonvolatile storage.

Brief Summary Text (12):
The diagnosis system may further include a recording medium, provided in the memory

cartridge, for storing the diagnosis programs.

Brief Summary Text (13):
The diagnosis system may further include an interface circuit provided in the cartridge for connecting the integrated circuit to the electronic control unit.

Brief Summary Text (14):
Further, according to the present invention, there is provided a diagnosis system for conducting diagnosis with data read out of an electronic control unit with a communications protocol installed in a vehicle, comprising: a main processor for conducting virtual data communication with the electronic control unit for diagnosis; and a subprocessor for executing a communications processing program suitable for the communications protocol to have data communication with the electronic control unit, wherein the subprocessor receives first data from the main processor and transfers the first data to the electronic control unit, and receives second data from the electronic control unit and transfers the second data to the main processor for the virtual data communication.

Brief Summary Text (15):
The diagnosis system may further include a memory cartridge detachable to the diagnosis system; and a recording medium for storing the communications processing program. The recording medium may store a diagnosis program executed by the main processor.

Brief Summary Text (16):
In the system, addresses of the communications processing program and the diagnosis program may be allocated in a storage area of the main processor, and the communications processing program is transferred to the subprocessor before the communications processing program is executed by the subprocessor.

Brief Summary Text (17):
The diagnosis system may further include an interface circuit for connecting the subprocessor to the electronic control unit.

Drawing Description Text (2):
FIG. 1 shows a front view of fault diagnosis equipment connected to an electronic control unit in an automobile, according to the present invention;

Drawing Description Text (3):
FIG. 2 shows circuit block diagrams of the electronic control unit and the diagnosis equipment as the first preferred embodiment according to the present invention;

Drawing Description Text (5):
FIG. 4 is a flowchart explaining the process of data communication and diagnosis process in the first embodiment;

Drawing Description Text (6):
FIG. 5 shows circuit block diagrams of the electronic control unit and the fault diagnosis equipment as the second preferred embodiment according to the present invention; and

Drawing Description Text (7):
FIGS. 6A and 6B are flowcharts explaining the process of the data communication and the diagnosis process in the second embodiment.

Detailed Description Text (3):
FIG. 1 shows a front panel of a portable diagnosis equipment 100 according to the present invention. The diagnosis equipment 100 is connected to an electronic control unit 300 installed in an automobile 200 for diagnosis. Provided on the

front panel are a liquid crystal display screen 30, an indicator 31 of light emitting diodes and a keyboard 32. An input/output connector 33 and a power switch 35 are provided on top of the diagnosis equipment 100. An adaptor harness 34 is extending from the input/output connector 33. A memory cartridge 60 is inserted in the lower part of the diagnosis equipment 100. The cartridge 60 will be described later.

Detailed Description Text (4):
To diagnose any fault occurring in the electronic control unit 300: first, connect the adaptor harness 34 to a connector 2a of the control unit 300; second, turn on the power switch 35; third, enter specific keys on the keyboard 32; and lastly, execute diagnosis while looking at displays on the display screen 30.

Detailed Description Text (5):
The preferred embodiments employ an engine control unit (ECU) 2 to be diagnosed as the electronic control unit 300 as shown in FIG. 2. Besides engine control, the electronic control unit 300 may be used for: power train control of an engine, an automatic transmission, etc.; vehicle body control, such as air conditioning and several information guidance systems; vehicle control, such as suspension control and auto-cruising, etc.

Detailed Description Text (7):
Data signals applied to the input interface 6 are: a coolant temperature signal TW produced by a coolant temperature sensor 10; a lean/rich signal .lambda. of an air-fuel ratio produced by an oxygen sensor 11; an intake air quantity signal Q produced by an intake air sensor 12; an ON/OFF signal SWa of an air conditioner switch 13; a vehicle speed signal S produced by a speed sensor 14; an ON/OFF signal SW1 of an idle switch 15; a throttle signal Tr.theta. produced by a throttle sensor 16, the signal Tr.theta. representing a throttle opening degree; an ON/OFF signal SWn of a neutral switch 17; and an engine speed signal N produced by an engine speed sensor 18.

Detailed Description Text (10):
Also connected to the driver 9 is a self-diagnosis indicator 24 for notifying faults when discovered by self-diagnosis function. The indicator 24 has a set of lamps which are flicked by predetermined times or turned on in a predetermined manner. These light indications respond to trouble codes read out of the ROM 4 and that correspond to fault portions.

Detailed Description Text (12):
The diagnosis equipment 100 is suitable for use at a repair shop in a car dealer, for instance. The diagnosis equipment 100 includes a controller 36 (microcomputer) and a voltage regulator 37. Connected to the voltage regulator 37 is the power switch 35 which is further connected to the battery V.sub.B via adapter harness 34. The detachable memory cartridge 60 with a ROM 61 is inserted into the controller 36 via connecter 38.

Detailed Description Text (13):
The controller 36 includes a CPU 40 as a main processor, a RAM 41, a timer 42 for generating a synchronizing signal, I/O interfaces 43 and 44, a communications interface (which will be described later). Via buses, these components and the ROM 61 of the memory cartridge 60 are connected to each other. The output signals of the sensors and switches of the ECU 2 are supplied to the I/O interface 43 via output interface 7. In response to the output signals, the I/O interface 43 generates signals to turn on the LEDs of the indicator 31. The LEDs indicate ON or OFF situations of the sensors and switches. A key entry on the keyboard 32 generates signals that are supplied to the I/O interface 44. The interface 44 generates signals that are supplied to the display screen 30.

Detailed Description Text (16):

The memory cartridge 60 is to make the diagnosis equipment 100 flexible for general use, or applicable to different diagnosis items, car types, communications protocols, etc. For these purposes, the ROM 61 stores a diagnosis boot program for the CPU 40, a diagnosis program for an electronic control unit (ECU 2) of a specific automobile, and logical data for reprogramming the FPGA 45. The ROM 61 does not necessarily store the boot program. A read only memory storing the boot program may be installed in the controller 36.

Detailed Description Text (17):
The memory cartridge 60 includes an I/O interface 62 that connects the FPGA 45 and the ECU 2. Communications lines 63a and 64a are connected to the I/O interface 62 via connector 38. Further, the Communications lines 63a and 64a lines are connected to the input and output interfaces 6 and 7 of the ECU 2, respectively, via input/output connector 33 and adapter harness 34.

Detailed Description Text (18):
The I/O interface 62 is used for converting signal levels, input/output performances, etc., into ones suitable for any types of ECU 2. Engine control units may be different in communications systems of automobiles. Further, such control units cannot be compensated for with the logical functions of the FPGA 45. Connected to the I/O interface 62 via connector 38 are communications lines 63b and 64b extended from the output and input terminals of the FPGA 45, respectively. The I/O interface 62 can be replaced with wires connecting the communications lines 63a and 63b, and 64a and 64b. This replacement is possible when the signals are matched to each other between the ECU 2 and the FPGA 45.

Detailed Description Text (19):
To diagnose any faults, insert the memory cartridge 60 with the ROM 61 into the diagnosis equipment 100. The ROM 61 stores the diagnosis program for the engine control unit (ECU) 2 of a specific automobile and design data. The diagnosis equipment 100 is initialized and the design data stored in the ROM 61 is transferred to the FPGA 45. The FPGA 45 is reprogrammed with the design data to be applicable to the diagnosis program and communications protocol for the ECU 2 of the automobile 200. Communication between the ECU 2 and FPGA 45 is thus made possible.

Detailed Description Text (20):
The flowchart shown in FIG. 4 will describe the process of the diagnosis operation with the diagnosis equipment 100.

Detailed Description Text (21):
To execute the process: first, connect the diagnosis equipment 100 with the memory cartridge 60 to the ECU 2 via adapter harness 34; and next, turn on the power switch 35 to reset the CPU 40 that governs the entire system of the diagnosis equipment 100. The entire system is thus initialized (STEP S101).

Detailed Description Text (25):
In STEP S106, the FPGA 45 transmits an answer request to the ECU 2 via communications line 63b, I/O interface 62 of the memory cartridge 60, communications line 63a of the diagnosis equipment 100, and adapter harness 34. This data transmission is done under the communications protocol of the ECU 2. The FPGA 45 then awaits the answer of the ECU 2 in STEP S107.

Detailed Description Text (27):
When the CPU 40 receives the answer in STEP S107, the CPU 40 executes a diagnosis program in STEP S108. While the program is running, a message representing that diagnosis is ready to start is displayed on the display screen 30 and the system goes in a key entry waiting mode.

Detailed Description Text (28):

To check a battery voltage, for example, an operator enters battery voltage diagnosis mode keys, such as "F", "0", "1", and "ENT" on the keyboard 32. This diagnosis mode is interpreted by the CPU 40 that transmits a request for battery voltage data to the ECU 2 via FPGA 45.

Detailed Description Text (29):
In reply to the request, the ECU 2 searches an address corresponding to the request in the RAM 5 to read out data. This data is transmitted to the diagnosis equipment 100.

Detailed Description Text (30):
On receiving, the diagnosis equipment 100 executes data processing, such as binary-to-decimal conversion. The processed result is displayed on the display screen 30. The operator checks the battery voltage through the display and continues diagnosing other items with corresponding key entry if desired.

Detailed Description Text (31):
As described above, the diagnosis equipment according to the first embodiment can be used for different types of electronic control units. This is achieved by exchanging the memory cartridges suitable for communications protocols with different data formats, transmission and reception timings, etc. There is thus no need for preparing other diagnosis equipment with different hardware for communications protocols of electronic control units. This results in highly efficient diagnosis operations.

Detailed Description Text (33):
Next, the second preferred embodiment of the diagnosis system according to the present invention will be explained.

Detailed Description Text (34):
As shown in FIG. 5, diagnosis equipment 100a has a controller 36a configured as a multiprocessor. The controller 36a includes a CPU 40a as a main processor, a RAM 41, a timer 42 for generating a synchronizing signal, I/O interfaces 43 and 44, and a subprocessor (ISP) 70. Via system buses, these components and a ROM 61a of a memory cartridge 60a are connected to each other. The ISP 70 sends and receives signals to and from an electronic control unit (ECU 2) in data communication via system buses in the controller 36a.

Detailed Description Text (36):
The memory cartridge 60a is to make the diagnosis equipment 100a flexible for general use, or applicable to different diagnosis items, car types, communications protocols, etc. For these purposes, the ROM 61a stores several programs for the CPU 40a and ISP 70. The programs for the CPU 40a are a diagnosis boot program, a diagnosis program for the ECU 2 of a specific automobile, etc. The programs for the ISP 70 are a communications processing program adaptable to the communications protocol of the ECU 2, etc.

Detailed Description Text (37):
The memory cartridge 60a includes an I/O interface 62a that connects the ISP 70 and the ECU 2. Communications line 63a and 64a are connected to the I/O interface 62a via connector 38. Further, the communications lines 63a and 64a are connected to the input and output interfaces 6 and 7 of the ECU 2, respectively, via input/output connector 33 and adapter harness 34.

Detailed Description Text (38):
The I/O interface 62a adapts signal levels, input/output performances, etc., to the ECU 2 which are different in communications systems of automobiles and which cannot be emulated with software. Connected to the I/O interface 62a via connector 38 are communications lines 63b and 64b extended from the output and input terminals of the ISP 70, respectively. The I/O interface 62a can be replaced with wires

connecting the communications lines 63a and 63b, and 64a and 64b. This replacement is possible when the signals are matched to each other between the ECU 2 and the ISP 70.

Detailed Description Text (39):
The CPU 40a has storage areas for the programs or data stored in the RAM 41 of the controller 36a and the ROM 61a of the memory cartridge 60a. The system of the diagnosis equipment 100a runs with a boot program stored in the ROM 61a. This boot program is not necessarily stored in the ROM 61a. The program can be stored in a ROM (not shown) of the controller 36a. Or, when the CPU 40a is a device having an internal ROM, the boot program can be stored in the internal ROM.

Detailed Description Text (40):
The ISP 70 makes one diagnosis equipment 100a suitable for data communication with electronic control units with different communications protocols of several types of automobiles. Thus, the ISP 70 can be said as intelligent I/O interfaces of a microcomputer. In this second embodiment, the ISP 70 is one chip device including a ROM storing the boot program, RAMs for storing data, and I/O interfaces.

Detailed Description Text (41):
To diagnose any faults, insert the memory cartridge 60a with the ROM 61a into the diagnosis equipment 100a. The ROM 61a stores the diagnosis program for the engine control unit (ECU 2) of a specific automobile and communications processing program.

Detailed Description Text (42):
The diagnosis equipment 100a is initialized and the communications processing program stored in the ROM 61a is transferred to the ISP 70. The ISP 70 executes the communications processing program to have data communication with the ECU 2. In the data communication, the ISP 70 sends the data of the CPU 40a to the ECU 2 and vice versa.

Detailed Description Text (43):
On one hand, the CPU 40a reads and writes data from and to the ISP 70 to have virtual data communication with the ECU 2. On the other hand, the ISP 70 conducts real data communication with the ECU 2 with the communications processing program sent from the ROM 61a of the memory cartridge 60a. The ISP 70 can have effective data communication with the ECU 2 independently of the diagnosis done by the CPU 40a.

Detailed Description Text (45):
The flowcharts shown in FIGS. 6A and 6B will describe the process of data communication and diagnosis. FIG. 6A shows the first process executed by the CPU 40a of the diagnosis equipment 100a. FIG. 6B shows the second process executed by the ISP 70 of the diagnosis equipment 100a.

Detailed Description Text (46):
To execute the first and the second process: connect the diagnosis equipment 100a with the memory cartridge 60a suitable for the ECU 2 of the automobile 200 via adapter harness 34; and turn on the power switch 35 to reset the CPU 40a that governs the main system of the diagnosis equipment 100a. Then, the first process shown in FIG. 6A starts.

Detailed Description Text (47):
In STEP S201, the main system of the diagnosis equipment 100a is initialized. Then, in STEP S202, the subsystem for data communication of the ISP 70 is reset to start the second process shown in FIG. 6B. In STEP S301 (FIG. 6B), the subsystem of the ISP 70 is also initialized.

Detailed Description Text (55):

In the first process, the CPU 40a reads the reply data from the ISP 70 and acknowledges the reply of the ECU 2 in STEP S207. The first process then goes to STEP S208 in which an application program on the diagnosis is executed. The message "diagnosis start OK" is displayed on the display screen 30 and the first process goes in a waiting mode for waiting key entry on the keyboard 32 while the application program is running.

Detailed Description Text (56):
To check a battery voltage, for example, an operator enters battery voltage diagnosis mode keys, such as "F", "0", "1", and "ENT" on the keyboard 32. This diagnosis mode is interpreted by the CPU 40a that transmits a request for battery voltage data to the ISP 70.

Detailed Description Text (58):
The CPU 40a reads the data sent from the ISP 70 and executes data processing, such as binary-to-decimal conversion. The processed result is displayed on the display screen 30. The operator checks the battery voltage through the display and continues diagnosing other items with corresponding key entry if desired.

Detailed Description Text (59):
As described above, the diagnosis equipment according to the second embodiment can be used for different types of electronic control units. This is achieved by exchanging the memory cartridges suitable for communications protocols with different data formats, transmission and reception timings, etc. There is thus no need to prepare other diagnosis equipment with different hardware for communications protocols of electronic control units. This results in highly efficient diagnosis operations.

Detailed Description Text (64):
The fault diagnosing equipment is equipped with an integrated circuit the logical functions of which is reprogramable on board with design data. The integrated circuit is employed as the communications interface suitable for the communications protocol of an electronic control unit installed in an automobile. The diagnosis equipment executes diagnosis with data sent from the electronic control unit in the data communication under the communications protocol. The diagnosis equipment according to the present invention thus can be used for several types of electronic control units with different communications protocols. This makes the diagnosis equipment flexible for general use and decreases cost for diagnosis.

Detailed Description Text (65):
Further, the design data for the integrated circuit that forms the communications interface is stored in a recording medium in a detachable cartridge. The diagnosis equipment is thus made suitable for different communications protocols of several electronic control units installed in automobiles. The diagnosis program is also stored in the same recording medium in the detachable cartridge. Hence, the program is easily converted into a diagnosis program suitable for an electronic control units on an automobile. This results in high diagnosis operability.

Detailed Description Text (68):
The communications processing program is externally convertible into the one suitable for the communications protocol of an electronic control unit installed in an automobile. The subprocessor executes the communications processing program to have data communication with the electronic control unit. And, the main processor for diagnosis exchanges data with the subprocessor. This means that the main processor has virtual data communication with the electronic control unit. The diagnosis equipment thus can be used without changing its hardware for several types of electronic control units with different communications protocols. This makes the diagnosis equipment flexible for general use and decreases cost for diagnosis.

Detailed Description Text (69):
Further, the communications processing program for the subprocessor is stored in a recording medium in a cartridge. This makes the stored program convertible to the communications processing program suitable for the communications protocol of an electronic control unit installed in an automobile. The diagnosis program for the main processor is also stored in the same recording medium in the cartridge. This also makes the stored program convertible to the diagnosis program suitable for the communications protocol of an electronic control unit on an automobile. Further, installation of the programs in the same recording medium results in high diagnosis operability.

Detailed Description Text (70):
Further, execution of the diagnosis program by the main processor and the communications processing program by the subprocessor are conducted with their own storage areas. The diagnosis processing and communications processing are thus executed independently of each other. This results in high processing capability.

CLAIMS:

1. A diagnosis device removably connectable to an electronic control unit installed in a motor vehicle for data communication, the electronic control unit having a communication protocol, the diagnosis device comprising:

a main processor provided for issuing a command directed to the electronic control unit and processing data transmitted from the electronic control unit in response to the command; and

a field programmable gate array provided between the main processor and the electronic control unit, the field programmable gate array being reprogrammable so as to make communication between the main processor and the electronic control unit possible under the communication protocol of the electronic control unit,

wherein the field programmable gate array is a communication interface with logical functions being reprogrammable on board by transmitted design data to make the communication interface applicable to the communication protocol of the electronic control unit, thereby enabling the diagnosis device to diagnose electronic control units having different communication protocols.

2. The diagnosis device according to claim 1, wherein:

the field programmable gate array includes either a volatile or a nonvolatile storage means for storing the transmitted design data.

3. The diagnosis device according to claim 2, further comprising:

a memory disposed in a detachable cartridge and operatively connected to the main processor, the memory including design data,

wherein the main processor reprograms the communication interface in accordance with the design data read out from the memory in the cartridge when the diagnosis device is activated.

4. The diagnosis device according to claim 1, further comprising:

a memory disposed in a detachable cartridge and operatively connected to the main processor, the memory including design data,

wherein the main processor reprograms the communication interface in accordance with the design data read out from the memory in the cartridge when the diagnosis device is activated.

5. A diagnosis device removably connectable to an electronic control unit installed in a motor vehicle for data communication, the electronic control unit having a communication protocol, the diagnosis device comprising:

a main processor provided for issuing a command directed to the electronic control unit and processing data transmitted from the electronic control unit in response to the command; and

a sub-processor provided between the main processor and the electronic control unit, the sub-processor being reprogramable so as to make communication between the main processor and the electronic control unit possible under the communication protocol of the electronic control unit,

wherein the sub-processor has a communication processing program being reprogrammable on board so as to emulate the main processor and the electronic control unit, thereby enabling the diagnosis device to diagnose electronic control units having different communication protocols.

6. The diagnosis device according to claim 5, further comprising:

a memory disposed in a detachable cartridge and operatively connected to the main processor, the memory including data of the communication processing program to make the sub-processor applicable to the communication protocol of the electronic control unit, wherein the main processor transfers the data of the communication processing program from the memory in the cartridge to a memory for the sub-processor when the diagnosis device is activated.

7. The diagnosis device according to claim 6, wherein:

the memory for the sub-processor is allocated in a storage area of the main processor.

8. A diagnosis method, comprising:

connecting a diagnostic device to an electronic control unit installed in a motor vehicle for data communication, the electronic control unit having a communication protocol, the diagnostic device comprising a main processor provided for issuing a command directed to the electronic control unit and processing data transmitted from the electronic control unit in response to the command; and a field programmable gate array provided between the main processor and the electronic control unit, the field programmable gate array being reprogrammable so as to make communication between the main processor and the electronic control unit possible under the communication protocol of the electronic control unit, wherein the field programmable gate array is a communication interface with logical functions being reprogrammable on board by transmitted design data to make the communication interface applicable to the communication protocol of the electronic control unit, thereby enabling the diagnosis device to diagnose electronic control units having different communication protocols; and

initiating communication of data between the electronic control unit and the diagnostic device.

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NAME	CITY	STATE	ZIP CODE	COUNTRY
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TITLE: Diagnostic system for a motor vehicle

Terms	Documents
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